



**Institute for Building Energetics,  
Thermotechnology and Energy Storage**  
Research and Testing Center for Thermal Solar  
Systems (TZS)  
**University of Stuttgart**



# **Test Report**

## **Solar Water Heater**

### **Determination of energy efficiency according to SASO 2884:2017**

Test Report No.: 23SU145

Stuttgart, March 30<sup>th</sup>, 2023

**Claimant:** Dimas SA Solar Energy Systems  
2nd km Argos-Nafplio  
21200 Argos  
Greece

**Manufacturer:** Dimas SA Solar Energy Systems

**Store:** Thermo 120

**Collector:** Energy+Evo 15

**Construction Year:** 2021

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<b>1 Technical data of store<sup>1</sup></b>			
Manufacturer:		Product type:	
Dimas SA Solar Energy Systems		Thermo 120	
Model year:	Serial No.:	Rated capacity:	Design:
2023	02450/23	110 liters	Horizontal Thermosiphon Tank
Country of manufacture:	Length <sup>2</sup> :	Diameter <sup>2</sup> :	Weight (empty):
Europe	1.04 m	0.50 m	not specified
<b>Water volume:</b>			
Corrosion protection:		Enamel Powder Coated, Magnesium Anode	
Max operation pressure:		8 bar	
Max operation temperature:		95 °C	
<b>Thermal insulation:</b>		Polyurethane: 50 mm	
<b>Mantle Heat exchanger</b>			
Max operation pressure [bar]:		3.0	
Max operation temperature [°C]:		95	
Volume of heat exchanger [liters]:		6.6	
Area [m <sup>2</sup> ]:		0.625	

<sup>1</sup> as stated by the manufacturer

<sup>2</sup> with insulation

<b>2 Technical data of collector<sup>3</sup></b>			
Manufacturer:		Type:	
DIMAS SA Solar Energy Systems		ENERGY+EVO 15	
Year:	Serial No.:	Weight (empty):	Design:
2021	10533821001318	20.0 kg	Flat plate collector
Gross area		1.51 m <sup>2</sup>	
Absorber area		1.35	
Length		1.503 m	
Width		1.007 m	
Height		0.085 m	
Max. operating pressure		10 bar	
Absorber volume		1.16 liters	
Stagnation temperature <sup>4</sup>		230 °C	

<sup>3</sup> as stated by the manufacturer

<sup>4</sup> determined by test laboratory

### 3. Calculation of the water heating energy efficiency $\eta_{WH}$

The water heating energy efficiency  $\eta_{WH}$  of the solar water heater is determined according to SASO 2884:2017, chapter C3.2.

#### 3.1 Parameters of the storage tank

Type:	Thermo 120
Rated capacity:	110 l
Tested capacity $V_{sto,tot}$ :	110.0 l
Back-up capacity $V_{sto,bu}$ :	55.0 l
Heat loss rate of the whole store $H_{sto,los,tot}$ :	1.12 W/K
Rated thermal losses $Q_{PR}$ :	1.21 kWh/24h
For further details see:	Test report: 23STO443, dated 14.03.2023 Test Institute: IGTE Universität Stuttgart

#### 3.2 Parameters of the solar collector

Type:	ENERGY+EVO 15
Gross area $A_G$ :	1.51 m <sup>2</sup>
Zero-loss efficiency $\eta_0$ :	0.725
First-order coefficient $a_1$ :	3.623
Second-order coefficient $a_2$ :	0.01
Incidence angle modifier $K_{hem}(50^\circ)$ :	0.96
For further details see:	Test report: 21COL1632, dated 19.11.2021 Test Institute: IGTE Universität Stuttgart

#### 3.3 Further parameters

Daily hot water load (tapping profile) $Q_{ref}$ : "M"	5.85 kWh
Conversion coefficient CC according to SASO 2884:2017:	1
Auxiliary electric consumption $Q_{aux}$ (no controller):	0 kWh
Heat generator water heating energy efficiency $\eta_{WH,nonsol}$ (electric heating element):	1
Monthly average cold water temperature $\vartheta_{w,low}$ according to EN 15316-4-3:2017:	10 °C
Hot water temperature $\vartheta_{w,high}$ according to EN 15316-4-3:2017:	40 °C
Power collector loop pump $P_{sol;pmp}$ (no pump, thermosiphon system):	0 W
Number of collectors	1
Correction coefficient for the orientation of the collector $f_{col}$ : according to table A.9, EN 15316-4-3:2017	1.0
Type of system according to EN 15316-4-3:2017 (SOL_TYPE):	parallel
Efficiency factor of the collector loop $\eta_{loop}$ according to EN 15316-4-3:2017, F.2	0.97

Correction coefficient $f_{app}$ according to EN 15316-4-3:2017, table B.19	1.08
Correlation factor a according to EN 15316-4-3:2017, table A.18	1.029
Correlation factor b according to EN 15316-4-3:2017, table A.18	-0.065
Correlation factor c according to EN 15316-4-3:2017, table A.18	-0.245
Correlation factor d according to EN 15316-4-3:2017, table A.18	0.0018
Correlation factor e according to EN 15316-4-3:2017, table A.18	0.0215
Correlation factor f according to EN 15316-4-3:2017, table A.18	0
Factor describing the effect of insulation of the auxiliary heating loop $f_{bu;ins}$ according to EN 15316-4-3:2017, table B.14	0.02
recoverable heat losses of the solar system $Q_{x;sol;ls;rbl,m}$ (without solar space heating system):	0 kWh
Annual operation time for solar loop pump $t_{aux}$ according to EN 15316-4-3:2017, table B.13	2000 h
Annual global irradiation $I_{glob,ref}$ according to SASO 2884:2017, table B2	1848 kWh/m <sup>2</sup>
Auxiliary energy consumption of the auxiliary heat generator $W_{x;bu;aux;nom,m}$ :	0 kWh
Heat losses of the auxiliary heat generator $Q_{x;bu;ls;nom,m}$ :	0 kWh

### 3.4 Results

Table 1: Monthly Contribution of the auxiliary heater to the heat demand  $Q_{w;bu;out,m}$  [kWh]

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
152.2	129.9	96.6	68.6	47.9	42.8	35.1	39.2	67.7	100.1	140.7	161.6

The annual non-solar heat contribution  $Q_{non,sol}$  is calculated according to equation 1:

$$Q_{non,sol} = \sum_{m=1}^{12} Q_{w,bu,out,m} = 1082.4 \text{ kWh} \quad (1)$$

The annual energy consumption  $Q_{tota}$  is calculated according to equation 2:

$$Q_{tota} = \frac{Q_{non,sol}}{1.1 \times \eta_{WH,non,sol} - 0.1} + Q_{aux} \times CC = 1082.4 \text{ kWh} \quad (2)$$

The water heating energy efficiency  $\eta_{WH}$  is calculated according to equation 3:

$$\eta_{WH} = \frac{220 \times Q_{ref}}{Q_{tota}} = 118.8 \% \quad (3)$$

Table 2: Energy efficiency classification for load profile “M” according to SASO 2884:2017:

Energy class	A	B	C	D	E	F	G
$\eta_{WH}$ [%]	210	140	93	87	80	73	65

## 4 Test occurrences

No special incidents

## 5 General

The determined results are only valid for the tested versions of the test samples.  
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The nomenclature of SASO 2884:2017 and EN 15316-4-3:2014/2017 was used.

Arrival of test samples: 26.08.2021 (collector), 07.03.2023 (store)  
Testing period: Collector: 08.09. - 21.10.2021  
Store: 07.03. – 10.03.2023  
Test location: Stuttgart, Pfaffenwaldring 10  
Identification of test samples: Adhesive label: C1632, 23STO443  
Test engineers: Dipl.-Ing. S. Bachmann,  
F. Sansonnens, Dipl.-Ing. (FH) C. Twerdy

Stuttgart, March 30<sup>th</sup>, 2023



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**Authentication:** Test report available by the following [link](#)